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KEYBOARD APPARATUS

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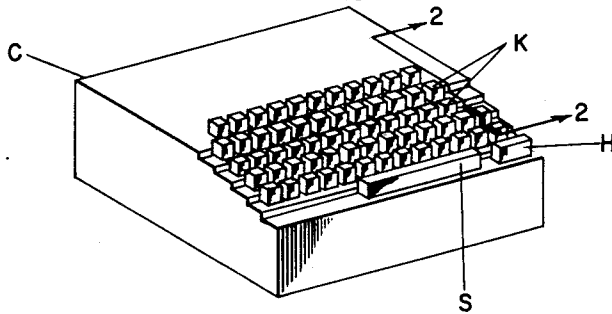


FIG. 1

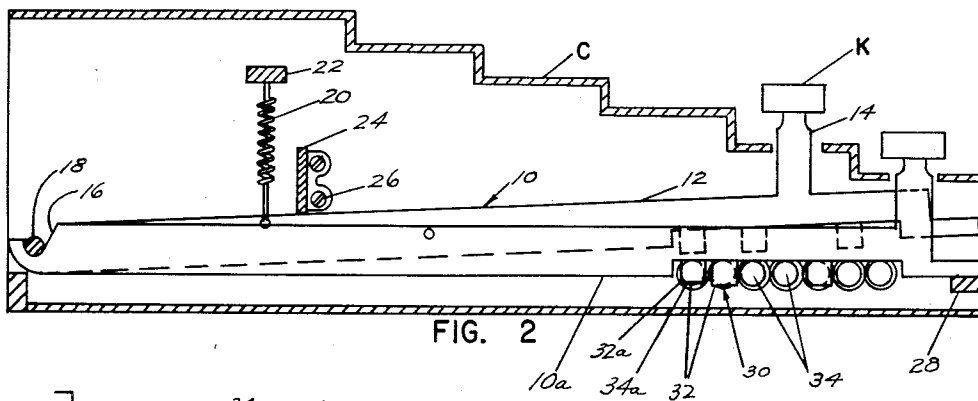


FIG. 2

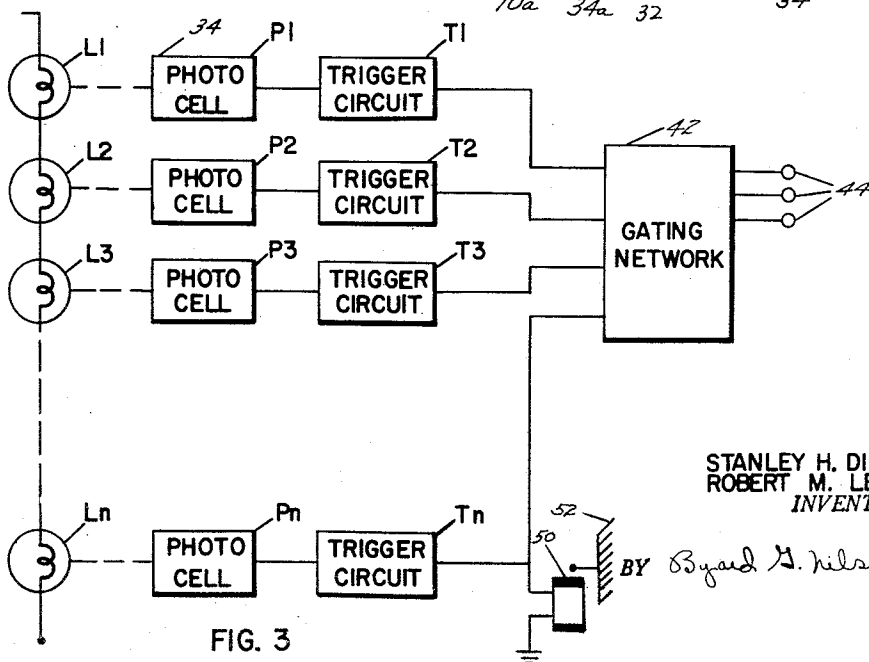


FIG. 3

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KEYBOARD APPARATUS

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The present invention relates to a keyboard apparatus, in which keys are individually manually operated to form signals indicative of intelligence symbols.

In recent years, scientific developments have resulted in the continuously increasing use of automatic data-handling equipment. In the fabrication of data-handling equipment, a need arises for an apparatus to manually convert intelligence symbols into representative intelligence signals. Various types of keyboards have been proposed in the past to perform the conversion operation under manual control. However, a need remains for an inexpensive, simple, and accurate keyboard apparatus for converting intelligence symbols into equivalent intelligence signals. Furthermore, as keyboard operators are accustomed to the touch of mechanical keyboards, as those employed in typewriters, it is desirable to provide a keyboard which has a similar touch.

An object of the present invention is to provide a simple, inexpensive keyboard apparatus which has a touch that is characteristic of a mechanical keyboard apparatus.

Another object of the present invention is to provide a keyboard apparatus wherein a plurality of switches as photo-sensitive switches are employed in conjunction with code patterns affixed upon the keys of the apparatus whereby to form symbolic intelligence signals.

These and other objects of the present invention will become apparent upon consideration of the following in conjunction with the drawing, in which:

FIGURE 1 is a perspective view of a keyboard apparatus constructed in accordance with the present invention;

FIGURE 2 is a vertical sectional view along line 2-2 of FIGURE 1; and

FIGURE 3 is a diagrammatic representation of the electrical system employed in the apparatus of FIGURE 1.

Referring initially to FIGURE 1, keys K forming a keyboard are shown to extend out of a cover C. In the normal operation of the keyboard, the keys K are individually depressed to cause the apparatus contained under the cover C to produce electrical signals indicative of a numeral, letter or other symbol with which a depressed key is associated. The keys K may be arranged in accordance with standard patterns and may include a space key S and a shift key H.

Considering the illustrative embodiment of the present invention in greater detail, reference will now be made to FIGURE 2. Each of the keys K is affixed to a keybar 10 which includes an elongate horizontal member 12 integrally formed with a vertical member 14 upon which a key K is affixed. The left end of each of the elongate members 12 contains a slot 16, all of which receive elongate rod 18 that is transversely mounted at the rear of the cover C. The keybars 10 are pivotally movable relative to the rod 18 and are urged upwardly by springs 20 affixed between the bars and an elongate bracket 22. The upward movement of the bars 10 is limited by a stop member 24 transversely mounted above the keybars 10 and affixed to the cover C by screws 26.

The downward pivotal movement of the keybars 10 is limited by an elongate stop 28 transversely affixed in the cover C. The limited downward movement of the keybars 10 performs a switching operation by elements of a code pattern 30 formed in the lower edge of each of the bars 10 controlling separate switch means. The

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code patterns 30 are made up of extensions 32 which are integrally formed with the remainder of the keybar 10, and which are different on each of the bars in accordance with the signals to be formed.

The extensions 32 are aligned with photo cells 34 which operate in conjunction with light sources as will be hereinafter explained. Upon depression of a key K the associated keybar 10 is pivotally moved downwardly (as illustrated by the keybar 10a) to place the extensions 32 in a position to obstruct the light which would normally illuminate the photo cells. In this manner, a switching operation is performed which results in the production of binary code signals indicative of a particular intelligence symbol.

The electrical system associated with the photo cells 34 is considered hereinafter. The operation of the electrical system is commanded when the extension 32a interrupts the illumination of photo cell 34a. That is, the extension 32a is provided upon each of the keybars 10, and serves to indicate the depression of a key K. It is to be noted, that the extension 32a is shorter than the other extensions and is therefore last to interrupt the illumination of the photo cell associated therewith. This sequence is provided to assure that the extensions 32 are properly positioned prior to the time when the electrical system is commanded to form a representative electrical signal.

Reference will now be had to FIGURE 3 to consider the electrical system of the illustrative embodiment. A series of lights L1 through Ln are connected in a serial circuit which is adapted to be energized. The number of lights L1 through Ln coincides to the number of photo cells 34 and is dependent upon the capability of the apparatus. For example, if seven lights and associated photo cells are provided, signals may be formed which are representative of the letters of the alphabet, the numerals 0 through 9, and various other symbols. Associated with each of the lights L1 through Ln is a photo cell circuit P1 through Pn. The photo circuits P1 through Pn each include one of the photo cells 34 (FIGURE 2) and serve to provide a signal indicative of the light received from an associated one of the lights L1 through Ln. Physically, the extensions 32 may be positioned to prevent the light from one of the lights L1 through Ln from striking an associated photo cell in one of the photo cell circuits P1 through Pn. The photo cell circuits P1 through Pn may be variously constructed in accordance with well-known prior art. These circuits function to provide a signal which is inversely proportional in amplitude to the light received by the photo cell therein.

The output signals from each of the photo cell circuits P1 through Pn are applied respectively to trigger circuits T1 through Tn. The trigger circuits may comprise various well-known systems as monostable multivibrators, or threshold-biased thyatron tubes, which function to provide a regular pulse upon receiving a signal which exceeds a predetermined amplitude.

The pulses from the trigger circuits T1 through Tn are all applied to a gating network 42 which has a plurality of output terminals 44. The gating network 42 functions to pass the signals from all of the trigger circuits upon the occurrence of a pulse from the trigger circuit Tn. Therefore, the gating network consists of a group of "and" or coincidence gates, i.e. one gate for each of the trigger circuits. Thus, the gates each receive a signal from one of the trigger circuits T1-Tn, and another signal from the trigger circuit Tn. Gates of this type are well known in the prior art, and one illustrative form is shown and described in Patent 2,769,971 issued to C. J. Baske.

Returning to FIGURE 3, the photo cell Pn is associ-

ated with the extension 32a (FIGURE 2) and therefore the formation of a pulse by a trigger circuit Pn indicates the depression of one of the keys K. Furthermore, a pulse from the trigger circuit Tn indicates that the key K is fully depressed.

The pulse from the trigger circuit Tn, in addition to being applied to the gating network 42, is also applied through a solenoid 50 to ground. The solenoid 50 has a pivotally-mounted clapper 52 associated therewith which provides a mechanical striking sound upon energization of the solenoid 50. Therefore, it may be seen that upon the occurrence of a pulse from the trigger circuit Tn, a mechanical striking sound is produced by the solenoid 50 and the signals from each of the other trigger circuits are permitted to pass through the gating network 42 to the terminals 44.

Considering the operation of the illustrative embodiment of the present invention, normally all of the keys K will be held in an elevated position by the springs 20 so that each of the photo cells 34 is illuminated. As a result, the photo cell circuits P1 through Pn produce a low-amplitude signal which is inadequate to operate any of the trigger circuits T1 through Tn. As none of the trigger circuits are operated, no pulses appear at the output terminals 44. Of course, in accordance with conventional binary signal techniques, the existence of the low value for each of a plurality of two-state signals is indicative of no signal. That is, the illustrative embodiment of the present invention employs binary signal representation which comprises a plurality of two-state signals. A low value for all of these signals, appearing at the terminals 44 indicates that no signals representative of an intelligence symbol are being formed.

Upon the depression of one of the keys K the associated keybar 10 is pivotally moved downward about the rod 18 to position certain extensions 32 of the code pattern 30 so as to obstruct the light impinging upon certain of the photo cells 34. As the light striking the photo cells is obstructed, the signals from the photo cell circuits P1 through Pn increase in amplitude to a level adequate to operate certain of the trigger circuits T1 through Tn thereby providing a high-state or pulse signal from these circuits. The last of the trigger circuits to function in this manner is invariably trigger circuit Tn due to the short nature of the extension 32a. Upon the occurrence of a pulse from the trigger circuit Tn the signals from the other trigger circuits are applied through the gating network 42 to the output terminals 44 providing a binary code signal indicative of the symbol associated with the depressed key. Simultaneously with the appearance of the binary signals at the terminals 44, the solenoid 50 is operated to pivotally move the clapper 52 and thereby provide a striking or clapping sound similar to that inherent in the operation of a typewriter. The clapper 52 may comprise simply a metallic rod which has one end

affixed to a support (as indicated in FIGURE 3) and carries a magnetic tip on the other end, so as to strike the armature of the solenoid 50 when the solenoid is energized.

Upon release of a depressed key K, the photo cells 34 are all illuminated thereby providing low signals from the photo cell circuits P1 through Pn to again cause the signals at the terminals 44 to go to a low value and indicate no intelligence signal.

An important feature of the present invention resides in the simplicity of a system constructed in accordance therewith, resulting in an inexpensive but reliable apparatus.

It will be readily apparent from a consideration above that various forms of apparatus incorporating the present invention are possible. Therefore, the scope of the invention is to be limited only by the following claims.

We claim:

1. An apparatus for forming electrical code signals indicative of symbols associated with the keys of a manually-operated keyboard, comprising: a plurality of bars having various code patterns affixed thereto, said bars being controlled by said keys to be selectively placed in an operated position; a plurality of photo-electric devices for providing electrical signals and positioned to be variously operated by said code patterns when said bars are placed in an operated position; a gating network connected to receive a control signal from one of said photo-electric devices, which one device is operative by each of said bars, said gating network being connected to receive signals from other of said photo-electric devices, said gating network functioning to pass code signals indicative of one of said symbols only upon depression of a key to place a bar in an operated position and upon receiving a control signal from said one photo-electric device; and an electrically-operated clapper means for providing a striking sound, said clapper means being connected to be operated by said control signal from said one of said photo-electric devices.

2. Apparatus according to claim 1 wherein said clapper device comprises a solenoid coil unit connected to be energized by said one of said photo-electric devices and a rod mounted to strike said coil unit in a single stroke upon the energization thereof.

3. Apparatus according to claim 1 wherein said plurality of bars comprise elongate pivotally-mounted metal strips affixed to said keys and having a section including variously-arranged extensions to comprise code patterns.

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